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(71) Applicant (*for all designated States except US*): BOUNDARY TECHNOLOGIES PTY. LTD. [AU/AU]; 8 Sedwick Street, Attadale, W.A. 6156 (AU).

(72) Inventor; and
(75) Inventor/Applicant (*for US only*): HAWKEN, Peter, James [AU/AU]; 8 Sedwick Street, Attadale, W.A. 6156 (AU).

(74) Agent: CHRISTIANSEN, John; P.O. Box 287, Port Melbourne, VIC 3207 (AU).

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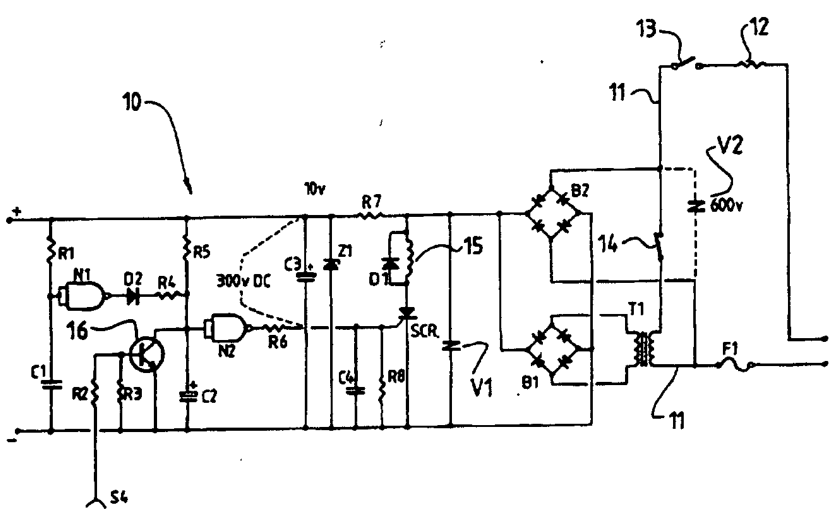

(57) Abstract

A power utility manages the total load on its electricity supply system by remotely deactivating specific loads (12) connected to the system. This is accomplished by locating a power control unit (10) at a particular premises. The power control unit (10) is connected to, and powered by, a line supplying power to a specific load (12). The utility sends a signal (S4) to the power control unit (10) via a commercial paging network when it determines that a power control unit (10) be activated. When the signal (S4) received by a receiver is passed to control circuitry in the unit, the circuitry operates to activate a relay (15), which in turn opens a switch (14) which disconnects the load (12). After a predetermined time, the relay (15) changes state, causing the switch (14) to close, thus reconnecting the load (12) to the system. The unit (10) may be located in a housing adapted to be plugged into a fuse or circuit breaker socket of a switchboard.

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MANAGEMENT OF AN ELECTRICAL SUPPLY SYSTEM BY REMOTE DEACTIVATION OF LOADS

This invention relates to the management of the supply of electricity to consumers, and in particular relates to a method and apparatus for controlling the delivery of electrical power to loads.

In Australia, historically, the electricity industry was run by large state-owned monopolies which were vertically integrated such that the one organisation generated the electricity, transmitted it at high voltage over large distances to load centres, and then distributed it at lower voltage to its customers. With such single monopoly organisations, there was no incentive to manage the load requirements, because an over-supply of generating capacity meant that it was relatively easy to activate a further generator to cater for increased loads at particular times.

The electricity industry is now going through dramatic changes such that the various functions of the industry are being dis-aggregated and are now being performed by different organisations - many of which have been privatised or are intended to be privatised - or where the functions are still being performed by a single organisation, there is transfer pricing between different segments of the organisation. Now an electricity supplier (electricity distributor) purchases electricity from an electricity generator, and pays the owner of the electricity transmission network for carrying the power. Accordingly, it has become important for an electricity distributor to be able to reduce peak demand on the power system, and so reduce the price it pays to an electricity generating company for electricity.

The reduced peak power demand allows an electricity generating company to reduce the use of generating plants having higher operating costs. It also allows such a company to defer the installation of expensive new generation plants. Such cost savings are reflected in the pricing structure a generation company is able to set for supplying electricity to as distributor.

Thus, there is now a direct incentive for an electricity distribution company to better

manage loads on its system. Furthermore, it may be desirable to deactivate a particular load, in order to prevent an overload in the distribution network. This is particularly rel vant for utilities supplying power from a grid where under periods of high load it is undesirable to have additional loads introduced onto the grid system. In managing the supply of electricity to loads supplied by its system, to keeps costs down and to protect the system, it will be necessary for utilities to consider the disconnection of some loads at certain times.

It is known for an electricity utility to disconnect whole areas supplied by it in order to control the load serviced by it. Such load management techniques, although successful, are crude and result in customer dissatisfaction, because groups of customers are left without any electricity for a period of time.

Some ways in which disconnection may be more selective have been disclosed. AU-A-31504/93 describes a manner in which the load at a subscriber's premises may be controlled, in which changes to a computer program, running on a computer located at the premises for controlling the electrical load of the premises, are sent via a telephone line. Such an arrangement is a complex and costly way in which to manage loads on a supply system.

AU-A-74125/87 discloses a method of switching groups of appliances at a location on and off by transmitting signals through the conductors supplying the electrical power. Such an arrangement also has the disadvantage of being complex, and can be costly.

It is an object of this invention to provide an improved method and apparatus for managing the supply of electrical power to consumers.

The invention provides a method of managing the supply of electrical power from a supply system by selective deactivation of a predetermined load connected to said system, including the step of:

initiating the transmission of a signal adapted to control a power control unit

situated at a remote location, said unit being adapted to disconnect said load upon receipt of said signal.

The invention also provides a method of managing the total load on an electricity supply system by selective deactivation of predetermined loads connected to and supplied from said system, including the steps of:

placing at a remote location a power control unit, said power control unit being adapted to disconnect, on the receipt of a signal, one or more but not all loads on said system situated at said location;

generating said signal; and

transmitting said signal.

The invention further provides a method of managing the supply of electrical power from a supply system by selective deactivation of predetermined loads connected to said system, including the steps of:

causing the transmission of a signal adapted to be received at a remote location, said signal being adapted to operate a power control unit at said remote location, said unit being adapted to disconnect a load connected to said supply system, upon receipt of said signal; and

causing said load to be reconnected to said supply after a predetermined time period has elapsed from said disconnection.

The invention also provides an arrangement for the management of the load on an electrical supply system, in which selective deactivation of loads connected to and supplied by said system is carried out remotely, including power control means situated at a remote location, said power control means being adapted to disconnect a predetermined load from said system upon the receipt of a signal, said power control means including timing means for the reconnection of said load after a

predetermined period of time.

Th invention further provides an arrangement by which a power utility is able to manage the load upon an electricity supply system by remote deactivation of particular loads connected to and supplied by said system, including means to enable said utility to facilitate the transmission, when it is deemed necessary, of a signal adapted to be received and operate power control means at a remote location, said power control means being adapted to disconnect, on receipt of said signal, a particular load from said system, said power control means being operative to reconnect said load after a predetermined period of time.

The invention also provides apparatus for the disconnection of a particular load from an electrical power supply system, including means to disconnect said load from said system upon the receipt of a signal indicative of a desire to disconnect said load, and means to limit the time of said disconnection, said apparatus being powered from said supply system.

An embodiment of the invention, which embodiment may be preferred, will be described in detail hereinafter, with reference to the accompanying drawing, in which:

Fig. 1 is a circuit diagram of portion of a first embodiment of the invention, a unit for receiving signals from a utility and for switching a system load off as a result of the receipt of the signal; and

Fig. 2 is a circuit diagram of portion of a second embodiment of the invention, which caters for a system which suffers from voltage fluctuations.

The thrust of the embodiments of the present invention is the management of the load on an electricity supply system or network through remote operation of power control units such as that designated 10 in Fig.1, each of which is located at a customer's premises and which is connected in a circuit controlling one or more selected appliances or the like, to switch off those appliances. Selective

disconnection of those appliances enables the overall load on the supply system to be managed. The embodiment of Fig. 1 is described in relation to a dwelling, but it is to be understood that the invention is also applicable to commercial, industrial and institutional premises, where certain appliances may be safely and temporarily disconnected from the electricity supply system. The invention may also be used to remotely disconnect a customer who is in arrears with payment of electricity supply accounts. With such an approach, the nature of the disconnection is not likely to be short or temporary.

In any household there are electrical loads which could be disconnected from the electricity supply, for shorter or longer periods, without any noticeable change occurring. Such loads as lighting, power for cooking, computers and even appliances such as vacuum cleaners and televisions, would be regarded as essential, and one would not normally choose to selectively disconnect such loads in a power management system.

However, there are some loads, such as water heaters, refrigeration apparatus, pumping apparatus and some kinds of space heating, which may be disconnected for some length of time without any discernible effect on the occupants of the household. Such loads also have the advantage of using more electricity than most of the other appliances already described, and thus their disconnection would have a greater effect on the total load on the system. Some appliances, such as water heaters and bore and swimming pool pumps, are also normally located on their own circuits, which makes it easier to disconnect them.

This embodiment of the present invention envisages the use of a power control unit (PCU) 10, controlled by signals from the electricity utility or distributor, in a household, to disconnect such loads from the supply, to enable load management to take place across the entire system or part of it.

The embodiment of Fig. 1 shows the power control unit (PCU) 10, which is connected in series to power line 11 between a fuse F1 and the load 12, which in the case of the embodiment is a hot water service (not shown) which is controlled

by a thermostatically operated switch 13. In the embodiment, the power line 11 supplies AC electricity at the Australian standard 240V, at 50 Hz.

The power control unit 10 is preferably accommodated within a housing (not shown) which is intended to be installed in a switchboard located at a dwelling. In one desirable form the housing is designed so that it can be plugged into the switchboard. This form of the embodiment involves plugging in the housing into the switchboard in place of a fuse or mini circuit breaker. The front of the housing is fitted with a fuse socket, into which the fuse or mini circuit breaker may be plugged.

Alternatively, the PCU could be hard-wired into the switchboard after the existing fuse or circuit breaker. A further alternative may involve the use of a DIN mounted circuit board, into which a power control unit 10 may be plugged.

As the unit 10 derives its power from the power line 11, it is therefore only active when the thermostatically operated switch 13 is closed to activate the load 12. The power supply for the circuit of the unit 10 comprises a first bridge B1 having its input connected to a secondary winding of a transformer T1, which operates at around mains voltage. Current transformer T1 is powered by the power supply line 11. The primary winding of transformer T1 comprises a small number of windings in order to provide a power supply to the bridge B1 of generally 200V to 400V at about 12mA. An alternative embodiment of the circuit of Fig. 1 may include a neutral connection, in which case PCU 10 would be powered at all times.

The power control unit 10 also includes a main switch 14 which is operated by means of a relay 15 and which is normally in a closed state. When the main switch 14 is closed and the thermostatically operated switch 13 is closed, there is current flow through the primary winding of the transformer T1 in order to deliver power to the power control unit 10. When the main switch 14 is opened and the thermostatically operated switch 13 is closed, power for the unit 10 is derived through a second bridge B2 which has an input connected to either side of the main switch 14.

The power control unit 10 includes a control circuit which controls delivery of current to the relay coil 15 in order to effect selective activation of the relay coil 15 to open the main switch 14. Relay 15 has a 10ms time period for it to drop out. The control circuit also includes a first NAND gate N1 which is used to charge the main timing capacitor C2 - initially through diode D2 and resistor R4 - almost instantly when a thermostat (not shown) operates to close the thermostatically operated switch 13 and power is applied to the unit 10. This may also occur when the unit is first plugged in to a switchboard, in the appropriate embodiment. This action serves to prevent the second NAND gate N2 from switching ON the silicon control rectifier SCR. Once C2 is initially charged through D2 and R4, R5 keeps it so, and is able to do so very quickly.

NAND gate N1 causes capacitor C1 to charge when the PCU 10 is initially turned on; when it is plugged in and the thermostat contact 13 is closed, in its fuse or circuit breaker embodiment.

The circuit further comprises an input S4 from a remotely operated receiver (not shown) whereby on receipt of a signal - to be described in more detail hereinafter - the transistor 16 is rendered conductive. This causes the main timing capacitor C2 to discharge which causes the second NAND gate N2 to switch ON the silicon controlled rectifier SCR and thus produce a current flow through the relay coil 15 which serves to open the switch 14.

Due to the presence of the second bridge B2 a current flow is maintained through the relay 15 when the main switch 14 is opened and will be maintained until the main timing capacitor C2 has recharged. The recharge of that main timing capacitor C2 is controlled through a resistor R5 and is for a predetermined period of time determined by the characteristics of the circuit. Typically, the charging time is between 1 and 8 minutes. On the completion of the recharging of the main timing capacitor C2 the silicon controlled rectifier SCR is switched OFF causing the relay 15 coil to drop out and the switch 14 to close. Electricity is then able to be supplied to the load. It can be seen that in any one operation (and subject to the discussion hereinafter about the necessity to repeat the disconnection operation) the

disconnection of a load 12 is intended to be of a short (for example, ≤ 5 hours) duration, and often is effected by a single signal. In most instances the interruption will be of relatively short duration and have little effect on the consumer. For example, where the load is a water heater, the effect may be that the water is slightly cooler.

Furthermore, the nature of the components used in the power control unit 10 are such that variance will occur in the actual period during which the electricity supply to the load 12 in interrupted. It is believed that over a group of five units, a variation of approximately ±15 seconds may occur. This is actually a positive aspect, because it is not really desirable that all loads disconnected by virtue of a signal being sent, be reconnected at the same time. That could result in the very thing which a utility is attempting to avoid, the overloading of the supply system. With this variation, staggered reconnection will occur, making the whole procedure more effective.

On initial activation of the power control unit 10, the normal secondary current drain from the transformer T1 is less than 2mA. When the relay is activated the current increases to about 12mA, and it remains at that level as long as the load is switched off. The 12mA requirement may make it difficult to house the power control unit 10 in a housing which may be plugged into a fuse socket in a switchboard. That is because of the spatial requirements for the transformer T1. It may well be that in an embodiment utilising a mini circuit board, such spatial problems may result in the housing for a unit 10 extending across a double space on the board. If only the communications circuitry and the control circuitry were included, it may be possible to use a single space, and wire the PCU 10 across to a separate relay or circuit breaker.

An alternative embodiment could involve the use of a bi-stable relay requiring only a short pulse to change state. In such an arrangement a miniature low-current relay controlled by the power control circuitry could be used to discharge a charged capacitor across the bi-stable relay, in order to change the relay state for each operation. That would facilitate the housing of all components within a body

adapted to be plugged into a fuse holder socket.

On the op ning of the main switch 14, the source of power is transferred to the second bridge B2. It has been found necessary for a varistor V1 to be included in the circuit of the power control unit 10 to limit the peak voltage at the time when the device is supplied with power. Preferably, the varistor V1 is able to clip a spike at about 400V in order to protect the circuit. As it is connected across the rails, varistor V1 is able to protect the entire PCU 10.

If desired, a further varistor V2 can be located across the input of the second bridge B2 to provide protection against spikes that may occur in the main power line 11. Other features of the circuit of Fig. 1 include resistors R7 (67kΩ) and R8, the latter of which holds the NAND gates N1 and N2 or the silicon control rectifier SCR down. Capacitor C3 is for power smoothing, and capacitor C4 keeps down spikes. Zener diode Z1 clips the voltage at 10V. A solid state switch could replace relay 15.

It can be seen that the power control unit 10 of the preferred embodiment does not need to be powered from any secondary power source such as a set of electrolytic cells which would necessitate regular servicing of the power control unit 10 but derives all of its power from the power circuit 11 with which the unit 10 is associated. In addition, the unit 10 of the embodiment of Fig. 1 will only be active when the load is active. In the event that a remotely transmitted signal S4 is received by the receiver when the load 12 is not active, there will be no operation of the unit 10.

It is anticipated that the embodiment will have application in controlling the delivery of power to heavy loads, such as electrically-operated hot water services, in domestic installations connected to a power grid, where under peak load conditions or unstable power conditions, such heavy loads associated with each or selected domestic installations can be deactivated by the utility to prevent the collapse of its electricity supply system or the power grid, or to keep the cost of electricity down, as previously discussed. It is also envisaged that the arrangement of the embodiment of Fig. 1 may be used to remotely operate such electrically-powered equipment as

garage doors, alarm systems, irrigation systems, watering systems, pumping systems, cooking equipment and so on.

The embodiment of Fig. 2 is intended to cope with electricity supply systems which suffer from large voltage fluctuations. In some countries with a nominal 220V AC electricity system, it is understood that at the customer's premises, the voltage may on some occasions fall to 180V. At such a depressed voltage level, the coil of most relays will not be able to operate reliably to open the contacts and disconnect the load 10.

The circuit of Fig. 2 specifies a DC coil 20 operating from a DC power supply with line 22 at +5V and line 24 at 0V. The coil 20 is normally closed, and being powered by a DC power supply which in turn is powered from the mains AC supply (not shown), will be much less affected by mains voltage fluctuations. In the DC circuit, there are connections 38 to a test switch and 40 to a relay switch.

The circuit of Fig. 2 has active (26) and neutral (28) connections to a 240V AC supply. On one side of relay RLY1 are fuses 30, 32, and on the other side there are appliances 34, 36, one or both of which may be thermostatically-operated water heaters.

Although the remote operation of power control power control unit 10 may be carried out by sending a signal to the receiver using any suitable means, the present invention's preferment is to utilise a commercial radio paging network to send signals from a utility to a receiver associated with the PCU 10, to provide the input S4 to the unit 10. Paging networks operate to send signals to pagers worn by or associated with persons, to enable messages to be sent to that person and displayed on the pager. There are a number of paging networks in Australia, the largest of which is operated by the Commonwealth Government-owned Telstra Corporation Ltd. Normally, a person would contact the network by telephone, subsequent to which the paging network's message handling system (MHS) will cause a radio frequency signal encoding the message to be transmitted. Normally, one may expect a short transmission queue of signals waiting to be transmitted, and

the signal intended for a PCU would take its place in such a queue.

With the present invention, the utility would desirably have a permanent or dedicated connection to the paging network. In a preferred arrangement, the system would be operated using a computer such as an IBM-compatible PC such as a 486, which runs specific software, and which includes such features as an internal fax modem type of, for example, at least 14.4 kb/s capacity, and a purpose-built card able to receive predetermined paging codes which are passed to the computer so that it will "know" which messages have been sent and at what time. Preferably, the computer contains an interface card or serial port connection which may be used to input to the computer the value of the instantaneous power demand on the system. Ideally, the computer is operated continuously, and at any one time an operator will use the computer to manage the operation of the various PCUs on the system.

Whenever it is determined by the utility to reduce the load on its electricity supply system, it would then send, via the abovementioned computer arrangement, to the paging system a signal for transmission by the network and for reception by receivers associated with predetermined units 10. The signal would placed by the network's MHS in the aforementioned queue (although it may be possible for a utility to be allotted a priority by the paging network) and then transmitted by one or more of the paging network's transmitters. The signal, having been received by a receiver, causes unit 10 to operate as previously described to switch off a load, or in embodiments other than that of Fig. 1, to prevent a load from being switched on by a thermostatically controlled switch.

It is envisaged that the receiver would be responsive - in that they are "awakened" - as would all the receivers of the PCUs in the system, to a particular code in the received paging network signal termed a CAP code, which CAP code may be relevant for a particular geographical area, such as a suburb or a group of suburbs. The term "CAP code" refers to the manner in which the paging network signals are encoded. In this way, a utility is able to disconnect loads within desired or necessary geographical areas. A second code could also be used, to allow other operations, for example to remotely reprogram the unit's time delay. While a

common part of such a signal may be that which activates a number of units 10, another part of the encoded message may be specifically coded to those power control units 10 located in a particular geographical area, for example, such that only those units in that area would be activated. In the same way, additional coding may instruct other action to be taken by the power control unit, or by associated means. In this way, it is theoretically possible to target certain areas supplied by a power utility, even individual premises - although that is not likely to be desirable - for the disconnection of loads from the utility's electricity supply system.

In a preferment, a signal would have a particular structure. In addition to the CAP code, the signal may contain instructions for a PCU to act upon. One exemplary structure is as follows:

"BT<Access Code Word><Global Code Word:f1.f2.f3.f4><Zone Code Word:f1.f2.f3.f4.><Unit Code Word:f1.f2.f3.f4>"

Each Code Word is desirably composed of ASCII characters, possibly 7-bit ASCII characters, typically four characters long. The legend for the above string is:

BT	is the system identifier, for example Boundary Technologies
Access Code Word	is the password which provides the sender with the authority to initiate a response from the PCU
Global Code Word	is a code that enables a global response from all the PCUs in a system
f1.f2.f3.f4	is a code which determines what action will be undertaken, for example turn off an appliance for a period, test a unit by turning off for 30 seconds, and so on

Zone Code Word	is a code which tells only the PCUs in the particular zone identified by the Zone Code Word to respond to the following instruction f1.f2.f3.f4
Unit Code Word	is a code which allows the system to access a particular PCU. The Unit Code Word corresponds, ideally, to the serial number of the particular PCU. The unit code will probably have to be longer than four characters in order to represent the unit serial number

The code f1.f2.f3.f4 is preferably a four-bit code.

A second exemplary structure is as follows:

"BT<Access Code><Global ID><Global Flags><Appliance ID><Appliance Flags><Area ID><Area Flags><Unit ID><Unit Flags>"

where

BT	has the same meaning as described earlier
Access Code	has the same meaning as "Access Code Word" described earlier
Global ID	has the same meaning as "Global Code Word" described earlier
Global Flag	is a code which determines what action will be taken on a "global" level, equivalent to the "f1.f2.f3.f4" code previously described

Appliance ID	is an identifier for a certain class of appliance
Appliance Flags	is a code which determines what action will be taken on an "appliance" level
Area ID	is an identifier for a particular geographic area, equivalent to the previously described "Zone Code Word"
Area Flags	is a code which determines what action will be taken on an "area" level, and is equivalent to the previously described f1.f2.f3.f4 code in relation to the "Area Code Word"
Unit ID	is an identifier for a particular unit, equivalent to the "Unit Code Word" described earlier, and is preferably the serial unit of the particular PCU 10
Unit Flags	is a code which determines what action will be taken on a "unit" level, and is equivalent to the f1.f2.f3.f4 code described earlier in relation to the Unit Code Word

With such a string, it is possible to address a particular class or type of appliance on a global, area or individual unit level. At least in part, the reason for including such a facility is the desire or need to control some appliances in a manner different from others. For example, off-peak water heaters could be controlled differently from other types of water heaters.

When installing a PCU 10, the installer would key into his or her portable computer the type of appliance connected to the system and the area code, and would use the attached bar code reader to enter the serial number of the particular unit, which would by way of a preference constitute the Unit ID. The computer would then send a message via a paging network to program the unit 10 with its area code and appliance code.

It is envisaged that default code words will be programmed into each PCU as they undergo a quality check on the production line and receive their serial number. The unit serial number will be printed onto a label by a testing computer and the label affixed to the unit. The serial number will also preferably be machine-readable, for example by being represented by a bar code.

Codes may be modified, either on a global, zone or individual basis by sending a high level security access code over the radio paging network, which will allow the PCUs addressed to respond to the subsequent command string, which will contain the memory address of the existing code word and the new code word. Examples of how this could be used are the alteration of the zone word for certain units, or the access password code could be changed on a global basis to thwart unauthorised access.

The code structure described hereinabove allows individual units to be assessed in the field for testing purposes. A field technician may carry a mobile test unit which incorporates a bar code reader, portable computer, radio modem or mobile phone and paging receiver. Using the bar code reader, the technician reads the unit serial number into the computer, closes the housing containing the PCU, and commences the test sequence. The computer accesses the paging network via the radio modem and sends the control codes which ask that particular unit to activate, say, for ten seconds. This test procedure properly applies to an embodiment of the invention with an active and neutral connection to the mains power supply, but with modification may also be applied to other embodiments.

The mobile test unit will advise when the signal is received, and that it was sent correctly. The technician then opens the housing to check that the indicating LED on the PCU is flashing to confirm that the PCU has received the signal, and that it has responded correctly by opening the normally closed relay. The technician also checks that the LED stops flashing after the expiry of the predetermined period to indicate that the unit has reverted to its normal mode of operation.

In power control unit 10 of Fig. 1, the receiver (not shown) may be powered from

the ± rails. Receipt of a signal by the receiver causes a positive pulse which short circuits around capacitor C2. Capacitor C2 discharges, such that the input at NAND gate N2 is low. The output of gate N2 goes high, which fires the silicon control rectifier SCR, which causes relay 15 to open. As previously described, relay 15 stays open for a predetermined time, and then drops out, closing switch 14 and restoring power, subject to the operation of the thermostatically-controlled switch 13, to load 12.

If the deactivation of a load is required over a period of time greater than the predetermined period in which the unit 10 is able to deactivate the load, a periodic signal may be sent, preferably via a paging network, to the receiver unit, the signal having a period less than the normal activation time of the relay to ensure that the relay 15 remains constantly active, thus ensuring a prolonged deactivation of the load.

As an alternative, the receiver could include a built-in software delay of, say four minutes, which could be included before the circuit of PCU 10. The circuit would still operate as described, with its random "time out". Another alternative could involve pager software including a pseudo-random algorithm to insert a randomness about the four-minute "time out". In such an alternative, the timing circuit of the power control unit 10 would not be required.

As has been stated, it is desirable that the power control unit 10 be incorporated within a housing which includes a fuse or circuit breaker, and which housing is able to plug into a fuse socket or mini circuit breaker board of a domestic, commercial, industrial or institutional power circuit switchboard in order that it cannot be selectively bypassed by the consumer and in order that it can be readily inserted into a supply circuit for the particular domestic, commercial, industrial or institutional load. Desirably, the unit 10 is provided with a monitor indicator or display which would show the state of the unit, that is, whether it is on or off. Such a feature would also allow for power technicians or meter readers to test the device, for example on routine visits to read the meter.

According to other embodiments the power control unit may be incorporated in other forms of connectors or with switches or power articles to facilitate remote control of power delivery to a load. The signal by which remote operation of the power control unit 10 is initiated may be sent by any appropriate known means, and is not restricted to use of a paging network.

CLAIMS

1. A method of managing the supply of electrical power from a supply system by selective deactivation of a predetermined load (12) connected to said system, including the step of:

initiating the transmission of a signal adapted to control a power control unit (10) situated at a remote location, said unit (10) being adapted to disconnect said load (12) upon receipt of said signal (S4).

2. A method according to claim 1, wherein said signal is sent via a paging network.

3. A method according to claim 1 or claim 2, wherein said unit (10) is powered from the line (11) from which said load (12) draws its power.

4. A method according to any preceding claim, wherein said unit (10) is contained within a housing adapted to be inserted into a fuse socket of a switchboard at said remote location.

5. A method according to any preceding claim, wherein said unit (10) contains a timing means to limit the period of disconnection to a predetermined amount of time.

6. A method according to claim 5, further including the step of sending a periodic signal, said periodic signal having a period less than said predetermined time, when it is desired to increase the time during which said predetermined load (12) is disconnected from said supply.

7. A method of managing the total load on an electricity supply system by selective deactivation of predetermined loads (12) connected to and supplied from said system, including the steps of:

placing at a remote location a power control unit (10), said power control unit

(10) being adapt d to disconnect, on the receipt of a signal (S4), one or more but not all loads (12) on said system situated at said location;

generating said signal; and

transmitting said signal.

8. A method according to claim 7, wherein said unit (10) is adapted to reconnect said or each load (12) to said system after a predetermined period of time.

9. A method of managing the supply of electrical power from a supply system by selective deactivation of predetermined loads (12) connected to said system, including the steps of:

causing the transmission of a signal adapted to be received at a remote location, said signal (S4) being adapted to operate a power control unit (10) at said remote location, said unit (10) being adapted to disconnect a load (12) connected to said supply system, upon receipt of said signal (S4); and

causing said load (12) to be reconnected to said supply after a predetermined time period has elapsed from said disconnection.

10. A method according to claim 9, wherein said time period is equivalent to the time taken to charge a particular capacitor in the circuitry of said unit.

11. A method according to claim 9, wherein said time period is at least partially provided by software associated with a receiver adapted to receive said signal (S4).

12. A method according to claim 10 or claim 11, wherein said time period at least includes a random component.

13. A method according to any preceding claim, wherein said signal (S4) has a structure including a CAP code for activating a power control unit, and a string of

commands for said unit.

14. A method according to claim 13, wherein the structure of said signal (S4) is:

"BT<Access Code Word><Global Code Word:f1.f2.f3.f4><Zone Code Word:f1.f2.f3.f4.><Unit Code Word:f1.f2.f3.f4>"

wherein:

BT	is a system identifier
Access Code Word	is a password which provides the sender with the authority to initiate a response from the power control unit
Global Code Word	is a code that enables a global response from all the power control units in a system
f1.f2.f3.f4	is a code which determines what action will be undertaken by the power control unit
Zone Code Word	is a code which tells only the power control units in the particular zone identified by the Zone Code Word to respond to the following instruction f1.f2.f3.f4, and
Unit Code Word	is a code which allows the system to access a particular power control unit.

15. A method according to claim 14, wherein the Unit Code Word is the serial number of the particular power control unit (10).

16. A method according to claim 14 or claim 15, wherein the code f1.f2.f3.f4 is a

four-bit code.

17. An arrangement for the management of the load on an electrical supply system, in which selective deactivation of loads (12) connected to and supplied by said system is carried out remotely, including power control means (10) situated at a remote location, said power control means (10) being adapted to disconnect a predetermined load from said system upon the receipt of a signal (S4), said power control means (10) including timing means for the reconnection of said load (12) after a predetermined period of time.

18. An arrangement according to claim 17, wherein said power control means (10) is powered from the line (11) supplying power to said load.

19. An arrangement according to claim 17 or claim 18, wherein said time period may be increased by the transmission of a further signal.

20. An arrangement according to any one of claims 17 to 19, wherein said or each signal is transmitted to said power control means (10) via a paging network.

21. An arrangement by which a power utility is able to manage the load upon an electricity supply system by remote deactivation of particular loads (12) connected to and supplied by said system, including means to enable said utility to facilitate the transmission, when it is deemed necessary, of a signal (S4) adapted to be received and operate power control means (10) at a remote location, said power control means (10) being adapted to disconnect, on receipt of said signal (S4), a particular load (12) from said system, said power control means (10) being operative to reconnect said load (12) after a predetermined period of time.

22. Apparatus for the disconnection of a particular load (12) from an electrical power supply system, including means to disconnect said load (12) from said system upon the receipt of a signal (S4) indicative of a desire to disconnect said load (12), and means to limit the time of said disconnection, said apparatus being powered from said supply system (11).

23. Apparatus according to claim 22, wherein said means for receiving said signal (S4) is a receiver adapted to receive signals transmitted by a paging network transmitt r.

24. Apparatus according to claim 22 or claim 23, wherein said apparatus is enclosed within a housing adapted to be plugged into a fuse socket for the circuit into which said load (12) is connected.

25. Apparatus according to any one of claims 22 to 24, further including means to control a relay (15), which itself is adapted to open or close a switch (14) in the circuit into which the load (12) is connected.

26. Apparatus according to any one of claims 22 to 25, wherein said load (12) is an electrically-powered water heater, and the circuit into which it is connected also is provided with a thermostatically-controlled switch (13).

27. Apparatus according to claim 22, wherein said means to limit the time of said disconnection includes circuitry to operate a relay coil (15), which in turn opens a switch (14) controlling the supply of electricity to said load.

28. Apparatus according to claim 27, wherein said circuitry includes a capacitor, the discharge of which, after a predetermined period, leads to the dropping out of said relay (15).

29. Apparatus according to claim 22, wherein said means to limit the time of said disconnection includes at least a random element.

30. Apparatus according to claim 29, wherein said means is computer software.

31. A method according to claim 13, wherein the structure of said signal (S4) is:

"BT<Access Code><Global ID><Global Flags><Appliance ID><Appliance Flags><Area ID><Area Flags><Unit ID><Unit Flags>"

wh r in:

BT	is a system identifier
Access Code	is a password which provides the sender with the authority to initiate a response from the power control unit (10)
Global ID	is a code that enables a global response from all the power control units (10) in a system
Global Flags	is a code which determines what action will be undertaken on a global level
Appliance ID	is an identifier for a certain class of appliance
Appliance Flags	is a code which determines what action will be undertaken on the level of a class of appliance
Unit ID	is an identifier for a particular power control unit (10), and
Unit Flags	is a code which determines what action will be taken in respect of a particular power control unit (10).

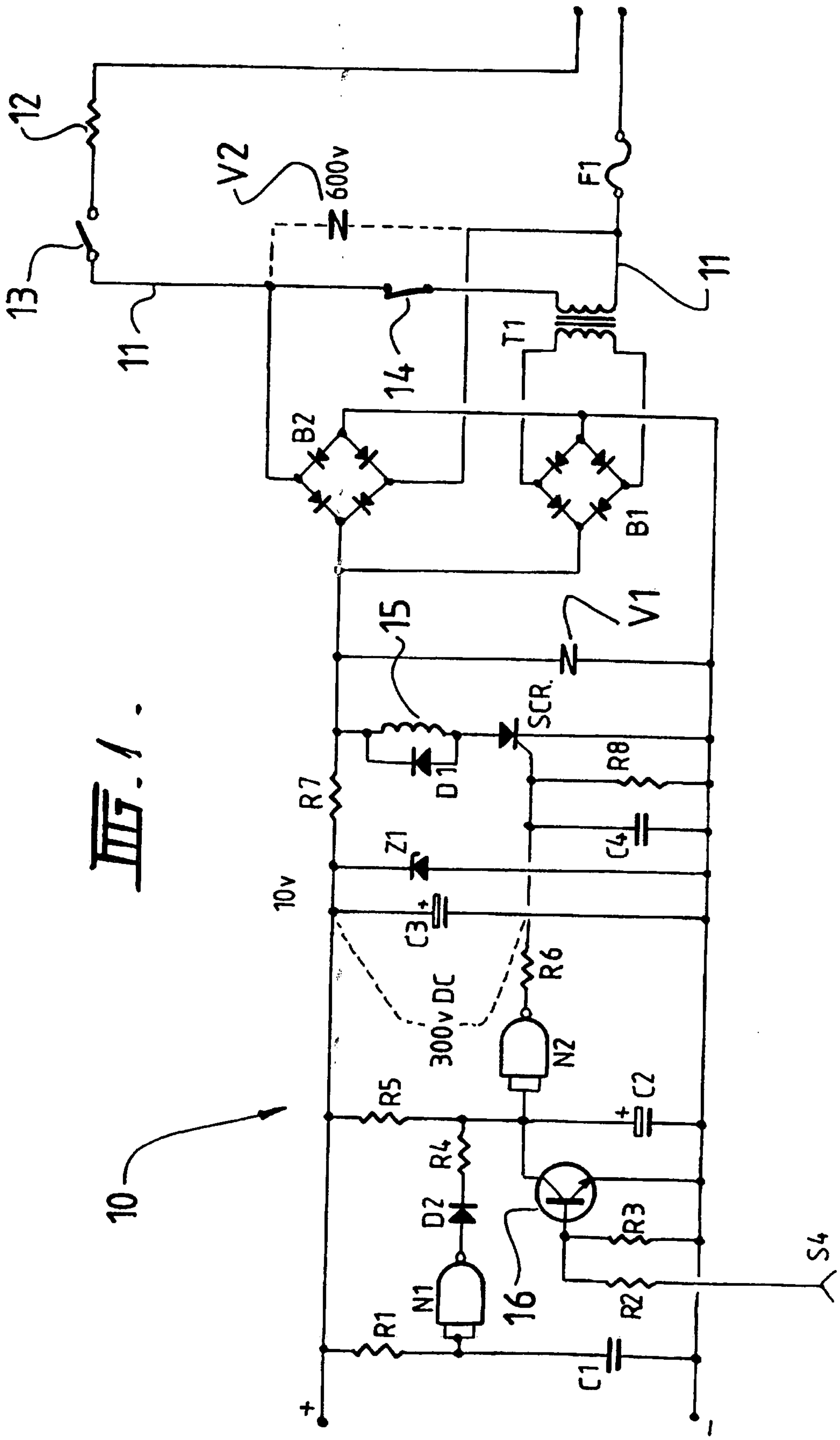
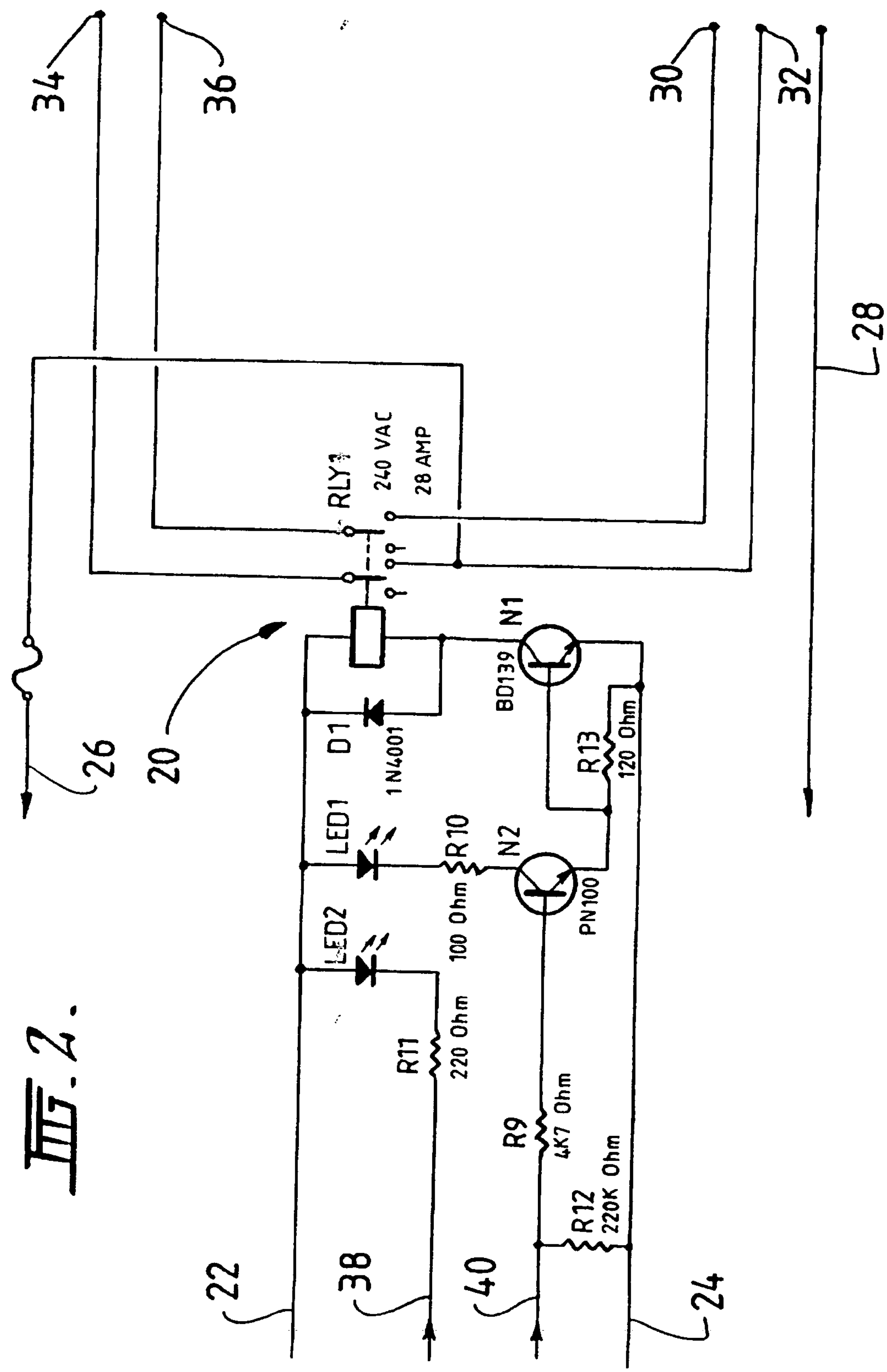

10
11
12
13
14
15
16
V1
V2
600v
F1
T1
B1
B2
R1
R2
R3
R4
R5
R6
R7
R8
C1
C2
C3
C4
D1
D2
N1
N2
Z1
SCR.
10v
300v DC
S4
+

FIG. 1.


34
36
30
32
28
RLY1
240 VAC
28 AMP
N1
BD139
D1
1N4001
26
20
LED1
R10
N2
LED2
100 Ohm
PN100
R13
120 Ohm
R11
220 Ohm
R9
4K7 Ohm
R12
220K Ohm
FIG. 2.
22
38
40
24

INTERNATIONAL SEARCH REPORT

International Applicati n No.
PCT/AU 96/00191

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl^6: H02J 13/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: H02J 3/14, 13/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Derwent and Japio: remote and (switch or connect) and load

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 5414640 A (Seem) 9 May 1995 Whole document	1, 7, 9, 17, 21-22 1-13, 17-30
X Y	US 5243225 A (Schweer) 7 September 1993 Whole document	1, 7, 9, 17, 21-22 1-13, 17-30
X Y	EP 561255 A (Mitsubishi Denki KK) 22 September 1993 Whole document	1, 7, 9, 17, 21-22 1-13, 17-30

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 July 1996	25 JUL 1996

Name and mailing address of the ISA/AU	Authorized officer
AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (06) 285 3929	R.G. TOLHURST Telephone No.: (06) 283 2187

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 96/00191

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP 007728 A (Motorola Inc) 6 February 1980 Whole document	1, 7, 9, 17, 21-22 1-13, 17-30
X, E Y, E	AU 31727/95 A (Boundary Technologies Pty Ltd) 4 April 1996 Whole document	1, 7, 9, 17, 21-22 1-13, 17-30
X Y	WO 85/01851 A (American Telephone & Telegraph Co) 25 April 1985 Whole document	1, 7, 9, 17, 21-22 1-13, 17-30
X Y	EP 023254 A (Sangamo Weston Inc) 4 February 1981 Whole document	1, 7, 9, 17, 21-22 1-13, 17-30
X, Y	DE 4333401 A (Siemens AG) 27 October 1994 Abstract	1, 7, 9, 17, 21-22 1-13, 17-30
X Y	EP 538078 A (Euro CP Sarl) 21 April 1993 Abstract	1, 7, 9, 17, 21-22 1-13, 17-30
X Y	AU 44619/89 A (Matsushita Electric Works Ltd) 1 March 1990 Whole document	1, 7, 9, 17, 21-22 1-13, 17-30

INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No.
PCT/AU 96/00191

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
EP	561255	US	5481140				
EP	7728	AU	529148	CA	1123050	DE	2963726
		US	4213058				
WO	85/01851	CA	129876	DE	3479074	EP	157860
		IT	1176881	US	4583182		
EP	23254	AU	60040/80	US	4348668		
EP	538078	FR	2682539				
AU	44619/89	CA	1332476	IT	1224700	US	5307058

END OF ANNEX